

IDAHO DEPARTMENT OF FISH & GAME

Jerry M. Conley, Director

MCCALL SUMMER CHINOOK SALMON HATCHERY
ANNUAL REPORT



1 October 1981 - 30 September 1982

by

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McCALL SUMMER CHINOOK SALMON HATCHERY

ABSTRACT

During April 1982, 122,247 summer chinook smolts were air-lifted and released in the South Fork Salmon River. Prior to release, two separate groups of fish were coded-wire tagged and freezebranded with one group being vaccinated against Vibrio anguillarum.

From the 482,941 eggs collected from returning adults at the South Fork trapping facility during 1981, approximately 257,296 fingerlings are on hand for release in April 1983.

During July, August, and September 1982, 502 two-and three-ocean fish and 48 one-ocean fish were collected at the South Fork trap. Nearly 29% of these fish were released upstream for natural spawning. A total of 648,520 eggs were collected from 147 females and at the end of the fish year, 532,486 eyed-eggs are on hand.

Of the 647,555 spring chinook eggs received from the Sawtooth trapping facility during 1981, approximately 398,000 fingerlings are on hand for release in April 1983.

During August and September 1982, 451,902 spring chinook eggs were collected at the Sawtooth trapping facility and transported to McCall for hatching and rearing. Resultant fish will be released in the Salmon River above the proposed Sawtooth Hatchery site in April 1984.

Special studies conducted during the year include: a feed study evaluating five different feeds, a study to evaluate three methods of counting eggs, and a study comparing egg mortality using two methods of fertilization.

"Spring Thing" was the only major disease encountered this year. Nearly 22% of the summer chinook and 29% of the spring chinook died as a result of this disease. To date, no causative agent has been found.

A "clean-up" contract to correct deficiencies at the South Fork trapping facility and the hatchery was awarded to Barton Construction Company, Boise, Idaho.

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OBJECTIVES

The objectives of the McCall Hatchery are:

FEDERAL

1. Raise 500,000 summer chinook smolts for release in the South Fork Salmon River.
2. Trap and spawn adult salmon returning to the South Fork Salmon River.
3. Raise 500,000 spring chinook smolts for release in the Salmon River.
4. Evaluate fish rearing capabilities of the McCall facility.

STATE

1. Redistribute approximately 23,000 pounds of catchable-size rainbow trout into area lakes and streams.
2. Hatch and rear approximately 500,000 trout fry for stocking in lowland waters and mountain lakes and for redistribution to other stations.
3. Stock nearly 600 mountain lakes in regions 2 and 3 on a three-year rotation basis.
4. Operate and maintain a fish trap at Fish Lake for the purpose of obtaining westslope cutthroat eggs.

This report covers all federal objectives accomplished at McCall Hatchery. For a report on state objectives, see Chapman (1983).

INTRODUCTION

The McCall Summer Chinook Hatchery was constructed in 1979-1980 as part of the Lower Snake River Compensation Plan (LSRCP). Congress authorized the LSRCP to compensate Idaho, Oregon, and Washington for losses of fish and wildlife caused by the Lower Snake River Projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams). This plan will provide hatchery capacity for the rearing of 9,160,000 chinook salmon smolts, 6,750,000 steelhead smolts, and 93,000 pounds of resident sport fish. McCall Hatchery is the first hatchery to be constructed as partial fulfillment of the LSRCP.

McCall Hatchery was constructed by the U. S. Army Corps of Engineers, is funded by the U. S. Fish and Wildlife Service, and is operated by the Idaho Department of Fish and Game. It is located within the city limits of Mc Call Idaho, on the North Fork Payette River, approximately 1/4 mile downstream from the Payette Lake regulating dam. Hatchery water is obtained from Payette Lake via a 36-inch underground pipeline. Two inlets, one at the surface near the dam, the other at a depth of 50 feet, approximately 1,500 feet from shore, provide the capability of obtaining the best water temperature available (Fig. 1). At maximum capacity, the facility requires 20 cfs of water. The fish rearing facilities include: 26 eight-tray stacks of Heath incubators, two fiberglass Heath troughs (1.75' x 15.5'), 14 concrete vats (4' x 40'), two outdoor gravel bottom-rearing ponds (42' x 200'), and one collection basin (15' x 101'). The design capacity of the hatchery is for production of 1,000,000 smolts at approximately 17 fish per pound.

An adult trapping and spawning facility is located on the South Fork Salmon River, near Cabin Creek, approximately 26 miles east of Cascade, Idaho. This facility is equipped with a removable fish weir, fish ladder, trap, two adult holding ponds (10' x 88'), and a covered spawning area. Water is supplied from the South Fork through a 33 inch-diameter underground pipe. Holding capacity for the facility is 750 adults. A portion of the returning adults are released above the fish weir for natural spawning. After spawning, the green eggs are transferred to McCall for incubation, hatching, and rearing.

GENERAL FISH CULTURE AND HEALTH

Loading

Heath incubators are loaded with approximately 80 ounces of eggs per tray. Eyed-eggs are shocked after accumulating 500 temperature units (T.U.), and mortality is removed by using the salt flotation method described by Lietritz and Lewis (1976).

After accumulating 1,600 T.U., fry are transferred to vats. Vat rearing volumes are established and changed by setting screens and drop gates at various distances and depths, insuring that fish densities are maintained at or below the Maximum Density Index (MDI) and Pond Loading Index (PLI) as recommended by Klontz (1979). Fish are transferred to the outdoor rearing ponds when they are about 250 fish per pound and held until their release, approximately 17 fish per pound.

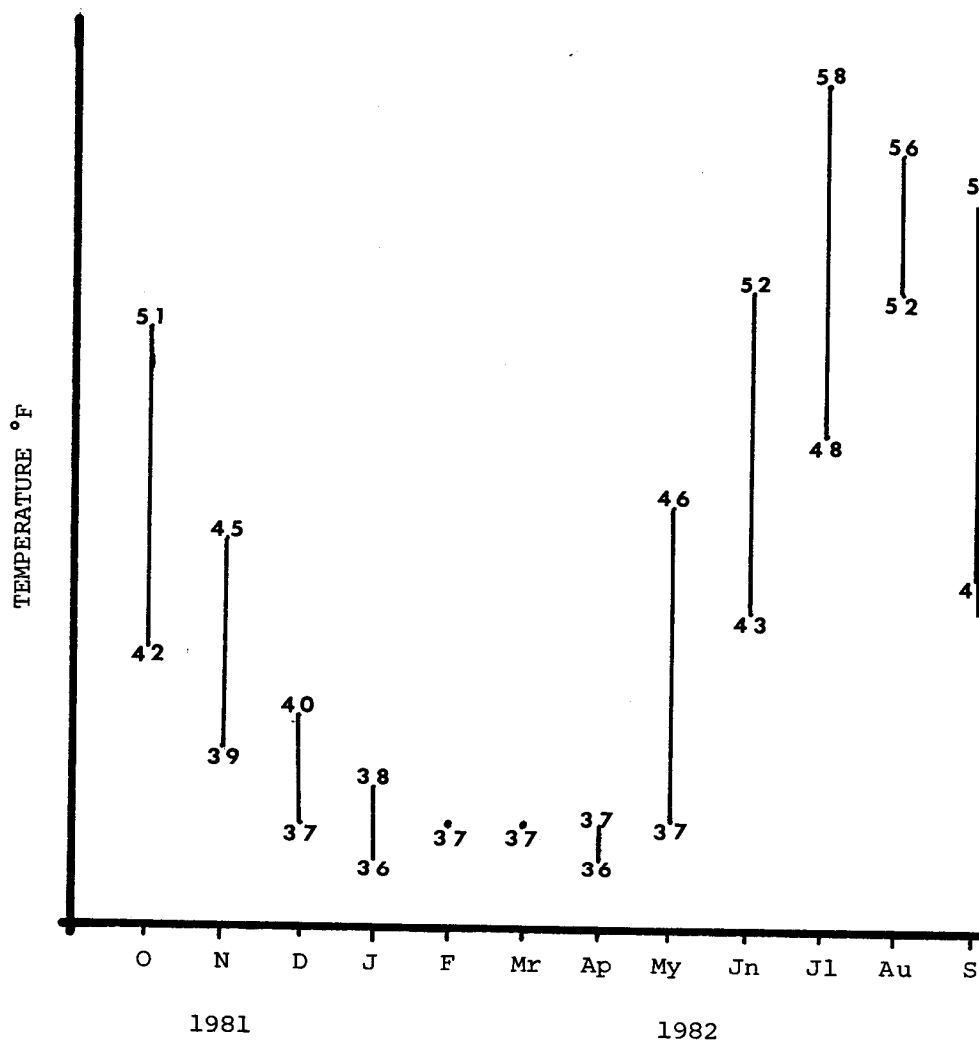


Figure 1. Monthly temperature ranges of McCall Hatchery w.

Hygiene

Eggs received at McCall are disinfected in a 1:300 solution of Argentyne and water for ten minutes. A 0.5% concentration of sodium bicarbonate is added as a buffering agent against the acidifying effects of Argentyne in soft water (Wood 1974). An ultraviolet light water purification system is used on incubation water, and for added protection against fungal invasion, eggs are periodically administered malachite green flushes.

Hatchery vats are cleaned daily and brushes and nets designated for each vat are disinfected in a 600 ppm Benzal-Chonium Chloride (50%) solution after each use. Hatchery personnel are required to disinfect their hands before cleaning any vat. Mortality is collected daily, recorded, and frozen for proper disposal. The outside gravel bottom rearing ponds have a concrete apron covering the last 30' and is cleaned on an "as needed" basis by means of a vacuum system which discharges into a sludge tank with eventual discharge into the settling pond. Pond mortality is collected, recorded, and frozen for disposal.

Inventories

Fish are inventoried on the 1st and 15th of each month. Length/weight relationships are determined, feeding levels adjusted, MDI and PLI are calculated, and necropsies are performed on a few fish to monitor general fish health.

SOUTH FORK BROOD YEAR 1980

Production

From 8-10 April 1982, 122,247 (6,852.4 pounds) summer chinook smolts were released in the South Fork Salmon River at Stolle Meadows (Table 1). They averaged 17.84 fish per pound and 140.5 mm (5.5 in) in length. These smolts originated from eggs taken from adults collected at Lower Granite Dam, trucked to Dworshak National Fish Hatchery for spawning, and also from adults collected at the South Fork trapping facility.

A long winter and heavy snowfall prevented vehicle access to the South Fork during April, the time the smolts had to be released. Therefore, an unusual but effective transportation method was used. A Bell 212 helicopter, equipped with a 400 gallon "monsoon" bucket, was used to airlift the fish to their destination. The buckets were loaded at a density of 300 pounds of fish per 200 gallons of water. Carbon stones, connected to oxygen tanks, were placed in the bucket where they remained until just prior to liftoff. During the 20 minute flight to Stolle Meadows, prop-wash

Table 1. McCall Hatchery fish production 1 October 1981 -
30 September 1982.

Brood Year	Species	Numbers Produced	Pounds Produced
1980 <u>1</u> /	Summer Chinook	122,247	6,852
1981 <u>2</u> /	Summer Chinook	257,296	8,408
1981 <u>1</u> /	Summer Chinook	1,000	6
1981 <u>2</u> /	Spring Chinook	398,054	12,173
1981 <u>2</u> /	Spring Chinook	20,625	75
Totals		799,222	27,514

1/ Planted

2/ On hand

agitated the water sufficiently and no adverse reactions were observed in the fish at time of release. Upon reaching the river, the helicopter lowered the bucket into the water, opened the valve in the bottom and rose slowly, thus expelling the fish. into the river.

Conversion

A total of 13,418 pounds of Oregon Moist Pellet (OMP)-II and OMP-II Double Vitamin Pak fish feed was fed to produce 6,852.4 pounds of fish (Table 2). A conversion ratio of 1.96 was attained for this brood year.

Disease

No major disease problems were encountered in the 1980 brood year fish this year. A heavy infestation of the gill parasite Trichophyra sue. was present upon release, but no adverse effects could be observed in the fish.

SOUTH FORK BROOD YEAR 1981

Production

From the 482,941 eggs collected at the South Fork last year, approximately 257,296 fish (8,408 pounds) are on hand for release during April 1983 (Table 1).

In July 1982, 1,000 summer chinook fingerlings were transferred to Merle Brusven (University of Idaho) for the completion of an aquatic insect feeding study on the South Fork. The fish were contained within the study area, but were to be released upon completion of the study at summer's end.

Conversion

This brood year was used in a feed study and was fed various brands of feed (Thorpe and Hutchinson 1982). A total of 7,598 pounds of feed was fed to produce 8,414.25 pounds of fish. A conversion ratio of 0.90 was attained for this brood year (Table 2).

Table 2. Feed conversion and cost per pound of fish produced

Brood Year	Species	lbs of fish Produced	Pounds Feed Fed	Cost	Conversion	Feed cost/lb Produced
1980	Summer Chinook	6,852	13,418	\$4,984.37	1.96	\$ 0.727
1981	Summer Chinook	8,414	7,598	2,955.76	0.90	0.351
1981	Spring Chinook	12,248	11,300	4,282.75	0.92	0.350
Totals		27,514	32,316	\$12,222.88	1.17	\$ 0.444
Cost per pound of fish produced excluding capital outlay:					<u>\$ 5.814</u>	

Disease

Several epizootics appeared in the 1981 brood year fish this year. During January, signs of a systemic bacterial infection appeared in one vat of fish. Microscopic examination, as well as media culture, confirmed the presence of a motile Aeromonas sp. bacteria. A treatment of TM-50, at four grams active ingredient per 100 pounds of fish for 14 days, was administered. Mortality subsided following treatment.

A few swim-up fry were observed with gas bubbles in their body cavity. Gas bubble disease was suspected, but readings on our Weiss Saturometer revealed nitrogen levels of only 99-101%, slightly below the 103-104% normally associated with this disease (Wood 1974). As no significant mortality appeared, no treatment was initiated.

What is commonly referred to as the "Spring Thing" manifested itself again this year. Nearly 22% of the entire brood year died from this disease. Affected fish exhibited the same symptoms as those reported by Wimer (1980) and Hutchinson (1981): flashing, hyperplasia of the gills, lethargy, no feeding response, some spiraling along axis, pinched-in appearance to the abdomen, yellowish fluid in the gut, and death as the end result. Samples of affected fish were sent to Wildlife Vaccine, Wheat Ridge, Colorado, for virological testing. Results came back negative and the cause of this disease remains a mystery.

A light infestation of Trichophyra appeared during September, but no mortality could be attributed to this parasite. As our gravel-bottom ponds appear to be the source of the reinfection, with no feasible means of effective cleaning, they will be replaced with concrete next year, hopefully eliminating this yearly problem.

ADULT RETURNS AND BROOD YEAR 1982

Trapping and Spawning

High water on the South Fork delayed installation of the weir until 20 July 1982. Trapping began on the 21st and terminated on 7 September. During this period, 502 two- and three-ocean fish (306 males and 196 females) and 48 one-ocean fish (< 62 cm) were trapped (Fig. 2). Of these, 145 two- and three-ocean fish (99 males and 45 females), and 13 one-ocean fish were released upstream for natural spawning. Fork lengths of all fish were recorded at time of capture (Fig. 3).

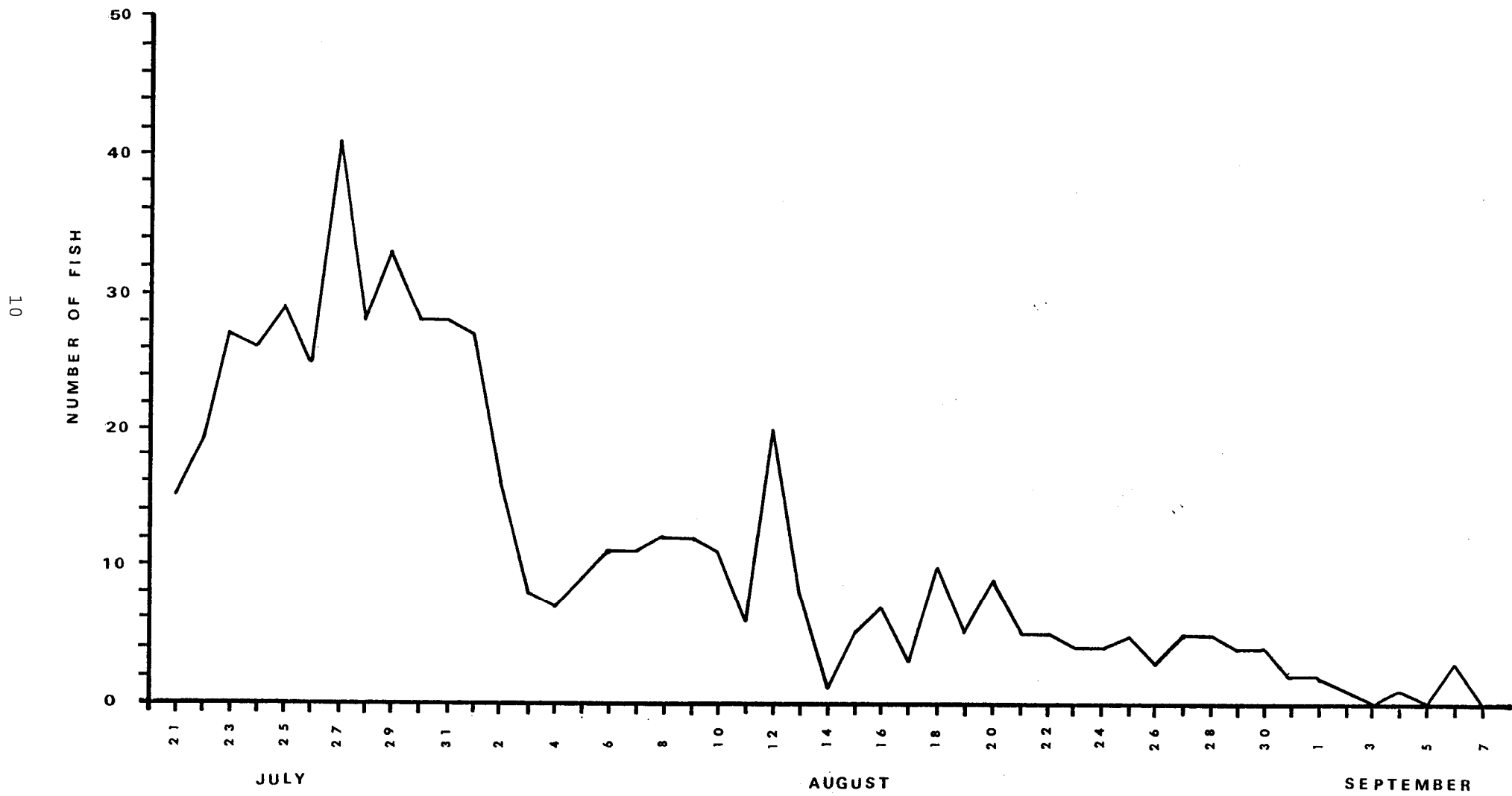
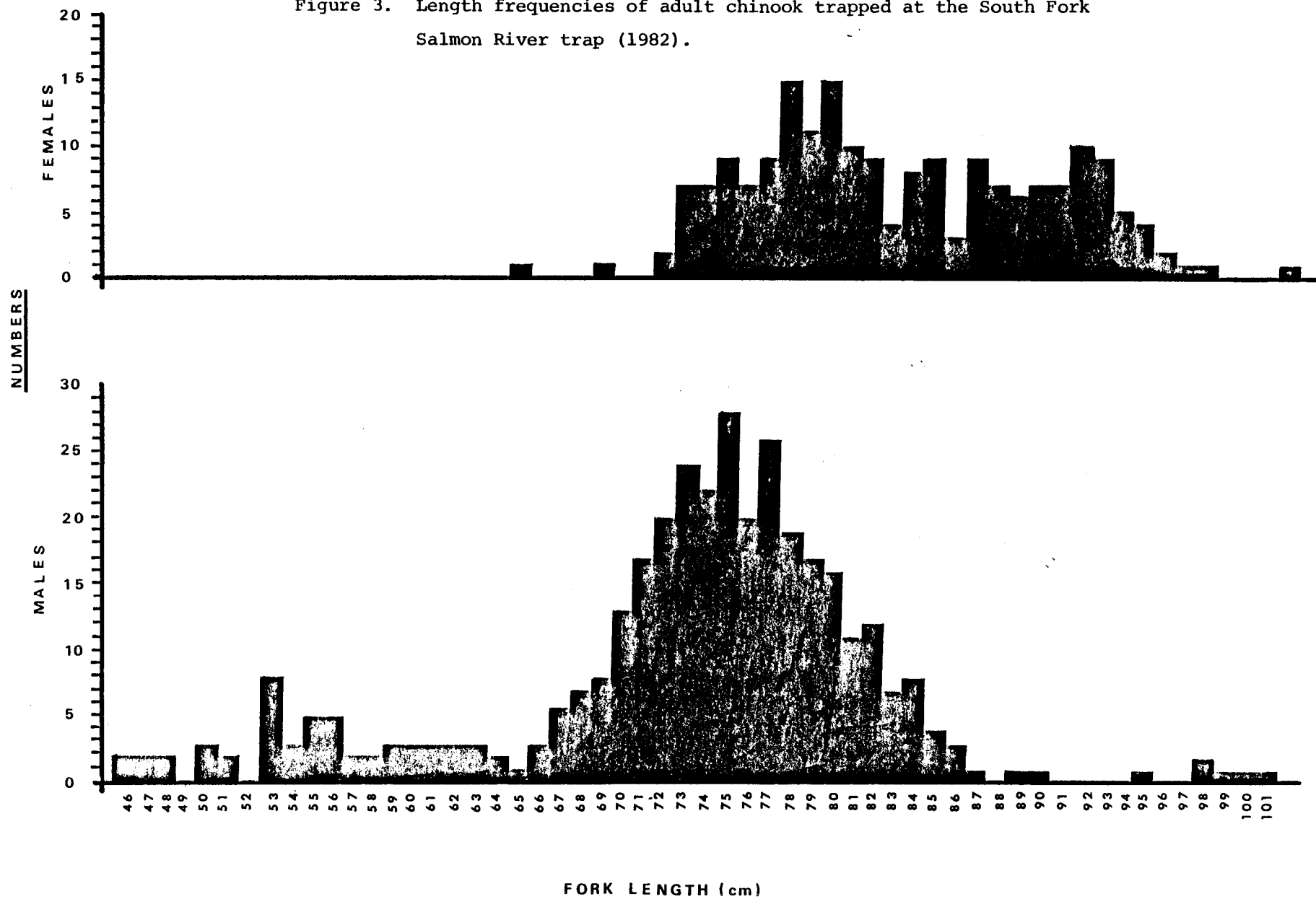


Figure 2. Timing of returning adults to the South Fork Salmon River trap (1982).

Figure 3. Length frequencies of adult chinook trapped at the South Fork Salmon River trap (1982).



Spawntaking began on 11 August and concluded on 7 September. During this period, 147 females were spawned, yielding 648,520 eggs, an average of 4,412 eggs per female (Table 3). Four females died prior to spawning from unknown causes.

All eggs taken at the South Fork were rinsed and water-hardened for one hour in a two ppm (active ingredient) concentration of Erythromycin (Gallimycin, Abbot). Twelve of the spawned females showed gross visible signs of Bacterial Kidney Disease.

Of the returning adults, 30 had adipose fins absent, indicating the possible presence of a coded-wire tag. Snouts from these fish were collected after spawning and sent to Rod Duke (IDFG Senior Fishery Research Biologist) for tag recovery and code identification (Table 4). Four of the snouts were found to contain no coded-wire tag, and one snout contained a National Marine Fisheries Tag, no data available (Rod Duke, personal communication).

No injections of erythromycin were administered to the adults, and all spawned-out fish suitable for human consumption were cleaned, packaged, frozen, and given away to charitable organizations.

SAWTOOTH BROOD YEAR 1981

Production

From the 647,555 spring chinook eggs received from the Sawtooth trapping facility last year, only 398,054 fish remain (Table 1). Resulting smolts will be released into the Salmon River above Stanley in April, 1983.

In July 1982, 20,625 spring chinook fingerlings were transferred to a portable raceway located on the proposed Sawtooth Hatchery site. These fish were used as part of an eye-fluke study that evaluated potential problems for the new hatchery.

Conversion

A total of 11,300 pounds of OMP-II fish feed was fed to produce 12,248 pounds of fish. A conversion of 0.92 was attained for this brood year (Table 2).

Disease

Only one disease manifested itself in the 1981 brood year for chinook. A mortality of nearly 29% was attributed to "Spring Thing."

Table 3. South Fork Salmon River summer chinook egg take and percent eye-up (1982).

Lot #	Date	Eggs taken	Eggs eyed	% Eye-up
1	8/11/82	135,854	98,054	72.0
2	8/13/82	48,920	43,969	90.0
3	8/17/82	80,855	68,230	84.0
4	8/20/82	120,457	113,916	95.0
5	8/24/82	82,578	66,019	80.0
6	8/27/82	35,402	28,138	79.5
7	8/31/82	87,866	68,604	78.1
8	9/3/82	23,616	17,293	73.2
9	9/7/82	32,972	28,263	85.7
Totals		648,520	532,486	82.1
	Number females spawned: <u>147</u>			
	Average eggs per female: <u>4,412</u>			

Table 4. Coded-wire tag recovery data (1982).

Fork Length cm	Code 325 1979 Release (3-ocean) Males	Code 325 1979 Release (3-ocean) Females	Code 2117 1981 Release (1-ocean) Males	<u>1/</u> Code 2118 1981 Release (1-ocean) Males	<u>2/</u> Code 2128 1981 Release (1-ocean) Males	<u>3/</u>
46					1	
47				1		
54			2		2	
56			2		1	
58			1		1	
60			1	2		
85		1				
87	1	2				
88		2				
89		2				
92		1				
96		1				
101		1				<u>1/</u> Control group
Totals	1	10	6	3	5	<u>2/</u> Vibrio
vaccinated group						
3/ Placebo group						

Note: Four snouts recovered contained no tag, one snout contained NMFS tag (no information available).

SAWTOOTH BROOD YEAR 1982

For the second year, a weir and fish trap were installed in the Salmon River above Stanley for the purpose of trapping adult spring chinook salmon (Moore 1982). Returning adults were collected by IDFG personnel and held in the Sawtooth holding pond until ready to spawn. A total of 451,902 eggs were taken and transported by air to the McCall Hatchery, where they will be hatched and reared (Table 5). Resulting smolts will be released in the Salmon River, above the proposed hatchery site, in the spring of 1984.

SPECIAL STUDIES

Coded-Wire Tagging and Vibrio Vaccination

In February 1982, Rod Duke and his tagging crew differentially coded-wire tagged, adipose fin-clipped, and freezebranded two groups of 1980 brood year summer chinook. Group one contained 42,385 fish, of which 8,512 were freezebranded with a = on the right dorsal surface (RD-U-4). Group two contained 42,054 fish and 12,684 were branded with a = on the right dorsal surface (RD-U-2).

Group one was vaccinated against Vibrio anguillarum by Bill Doerr (IDFG Fish Hatchery Superintendent I) and hatchery personnel. Fish were vaccinated with a Tavolek Vaccinator using the shower method. Group two was not vaccinated and was used as a control.

Freezebranding was done in order to identify these fish as McCall fish during the collection and transportation operation at Lower Granite Dam. These fish were released at the South Fork during 8-10 April 1982, and branded fish were observed at Lower Granite during the period 19 April - 11 June 1982 (Table 6) (Pat Chapman, personal communication). A comparison between the actual numbers of fish branded and those observed at Lower Granite is shown in Table 7.

Early returns from last year's vaccination program show that the vaccinated group had the least number of returns (Table 4). Because of this, and the fact that recent studies have indicated no advantage to Vibrio vaccination, it has been decided to eliminate the program.

Table 5. Sawtooth spring chinook egg take and percent eye-up (1982).

Lot #	Date	Eggs taken	Eggs eyed	% Eye-up
1	8/9/82	29,490	19,929	67.6
2	8/12/82	23,022	20,470	88.9
3	8/16/82	50,471	46,183	91.5
4	8/19/82	55,418	54,117	97.6
5	8/23/82	90,301	81,569	90.3
6	8/26/82	36,743	34,484	93.9
7	8/30/82	59,929	55,212	92.1
8	9/2/82	41,790	38,891	93.1
9	9/7/82	41,080	38,959	94.8
10	9/10/82	23,658	23,230	98.2
Totals		451,902	413,044	91.4

Number females spawned: 82

Average eggs per female: 5,511

Table 6. Timing of arrival of branded McCall Hatchery summer chinook smolts at Lower Granite Dam (1982).

Date	Brand	Number Observed 1/	Total
4/4-4/11	RD-U-2	0	0
	RD-U-4	0	
4/12-4/18	RD-U-2	0	0
	RD-U-4	0	
4/19-4/25	RD-U-2	1	1
	RD-U-4	0	
4/26-5/2	RD-U-2	0	0
	RD-U-4	0	
5/3-5/9	RD-U-2	8	18
	RD-U-4	10	
5/10-5/16	RD-U-2	14	30
	RD-U-4	16	
5/17-5/23	RD-U-2	23	37
	RD-U-4	14	
5/24-5/31	RD-U-2	4	4
	RD-U-4	0	
6/1-6/6	RD-U-2	4	6
	RD-U-4	2	
6/7-6/11	RD-U-2	2	3
	RD-U-4	1	
Total			99

1/ Sample size varied from 23-10% of total fish collected.

Table 7. Total numbers of branded McCall summer chinook smolts released and numbers observed at Lower Granite Dam (1982).

Brand	Number Branded	Percent	Number observed Lower Granite	Percent
RD-U-2	12,684	59.8	56	56.6
RD-U-4	8,512	40.2	43	43.4

FEED STUDY

A feed study was conducted on the 1981 brood year summer chinook to test the effect of feeding various diets in preventing "Spring Thing." We also evaluated performance with regard to growth, cost, and feed conversion. A report will be submitted for future publication (Thorpe and Hutchinson 1982). Results showed all test lots of fish contracted "Spring Thing." The best overall feed with regard to performance, etc., was OMP-IV.

EGG COUNTING

In an attempt to achieve a higher degree of accuracy in counting eggs, we tested three different methods: Von Bayer, total weight (dry), and water displacement. An entire lot of eggs was measured using each of the three methods. After the eggs had eyed, they were individually counted and the results compared to the original measurements (Table 8). Water displacement was shown to be the most accurate method, and total weight the least accurate. Although a significant difference can be seen, this was a small-scale experiment and further testing is needed to verify the results.

DELAYED FERTILIZATION

Because we have been experiencing relatively low eye-up percentages in eggs collected at the South Fork facility, we decided to see if transportation shock was the main cause. Egg mortality was evaluated between eggs fertilized at the South Fork using normal procedures and those fertilized at the hatchery using delayed fertilization. Techniques used for delayed fertilization were similar to those described by Carnes et al. (1981). Eggs from two females were collected in a dry bucket, then separated into two approximately equal groups. Group one was fertilized normally (sperm from several males is added, eggs are rinsed and water-hardened in erythromycin); the other group of unfertilized eggs were placed in a plastic bag, put into an ice-filled container and transported to the hatchery. Three males were killed, then dried with paper towels to remove all water remaining on them. Sperm was collected and placed in Whirl-pak bags. The bags were then charged with oxygen, laid down flat on ice, allowing for maximum surface exposure, and transported back to the hatchery. At the hatchery, the unfertilized eggs were placed in a bucket and the sperm added. Water was added, and after about one minute, the eggs were placed directly into a Heath incubator tray. After both groups had eyed, they were counted and mortality evaluated (Table 9). Although no significant difference was seen between these two methods, further testing is needed to better evaluate transportation shock.

Table 8. Comparison of three different egg counting methods.

Tray	Water Displacement	<u>NUMBERS</u>			<u>% DIFFERENCE</u>		
		Von Bayer	Total Weight	Actual	Water Displacement	Von Bayer	Total Weight
1	7,000	7,292	7,939	7,155	2.2	1.9	11.0
2	4,500	4,735	4,758	4,741	5.1	0.13	0.4
3	5,250	5,439	5,466	4,192	25.2	29.7	30.4
4	7,000	7,576	7,477	5,345	31.0	41.7	39.9
5	3,625	3,883	3,850	3,283	10.4	18.3	17.3
Totals	27,375	28,925	29,490	24,716	$\bar{x} = 10.8$	$\bar{x} = 17.0$	$\bar{x} = 19.3$

Table 9. Comparison of two different methods of egg fertilization.

	Eggs Taken	Eggs Eyed	Mortality	% Eye-up
Normal	4,326	4,233	93	97.9
Delayed	6,716	6,608	108	98.4

MISCELLANEOUS ACTIVITIES

Hatchery Completion Contract

A "clean-up" contract to correct construction deficiencies at the South Fork trapping facility and the hatchery was awarded to Barton Construction Company, Boise, Idaho. The contract will be completed in June 1983, and major changes include: modification of the trapping area, installation of a live box, a security fence around the trap, a dimmer system in the hatchery building capable of simulating natural photoperiods, concrete bottoms in the outside rearing ponds, and a drainage system around hatchery residences. The cost of the contract was \$183,898.00, and hopefully, is the last major construction needed at McCall.

Visitors

Over 3,500 people visited the hatchery during the year. Organized tours were given to Corps of Engineers, CH2M Hill, Greenleaf Friends Academy, McCall area cub scouts, and several classes from Meadows Valley and the McCall -Donnelly kindergarten, grade, and high schools.

Hatchery Dormitory

Our dormitory was again very popular this year. Over 50 Department personnel utilized this facility for professional and personal use. The dorm also provided residence for our Bio-Aide during the summer, as well as a Corps of Engineer inspector assigned to oversee construction outlined in the "clean-up" contract.

ACKNOWLEDGEMENTS

Hatchery staff during the year included: Bill G. Hutchinson, Fish Hatchery Superintendent II; Patrick Chapman, Fish Hatchery Superintendent I; John Thorpe, Fish Culturist; June Morse, Biological Aide; Christie Cockerham, Laborer; Thom Otto, Laborer; Harry Nicholson, Laborer.

The hatchery crew would like to thank the following people for their respective contributions during the year: Harold Ramsey, IDFG, Hagerman; Joe Lientz, U. S. Fish and Wildlife Service, Dworshak; and Charlie Smith, U. S. Fish and Wildlife Service, Bozeman, for disease investigations.

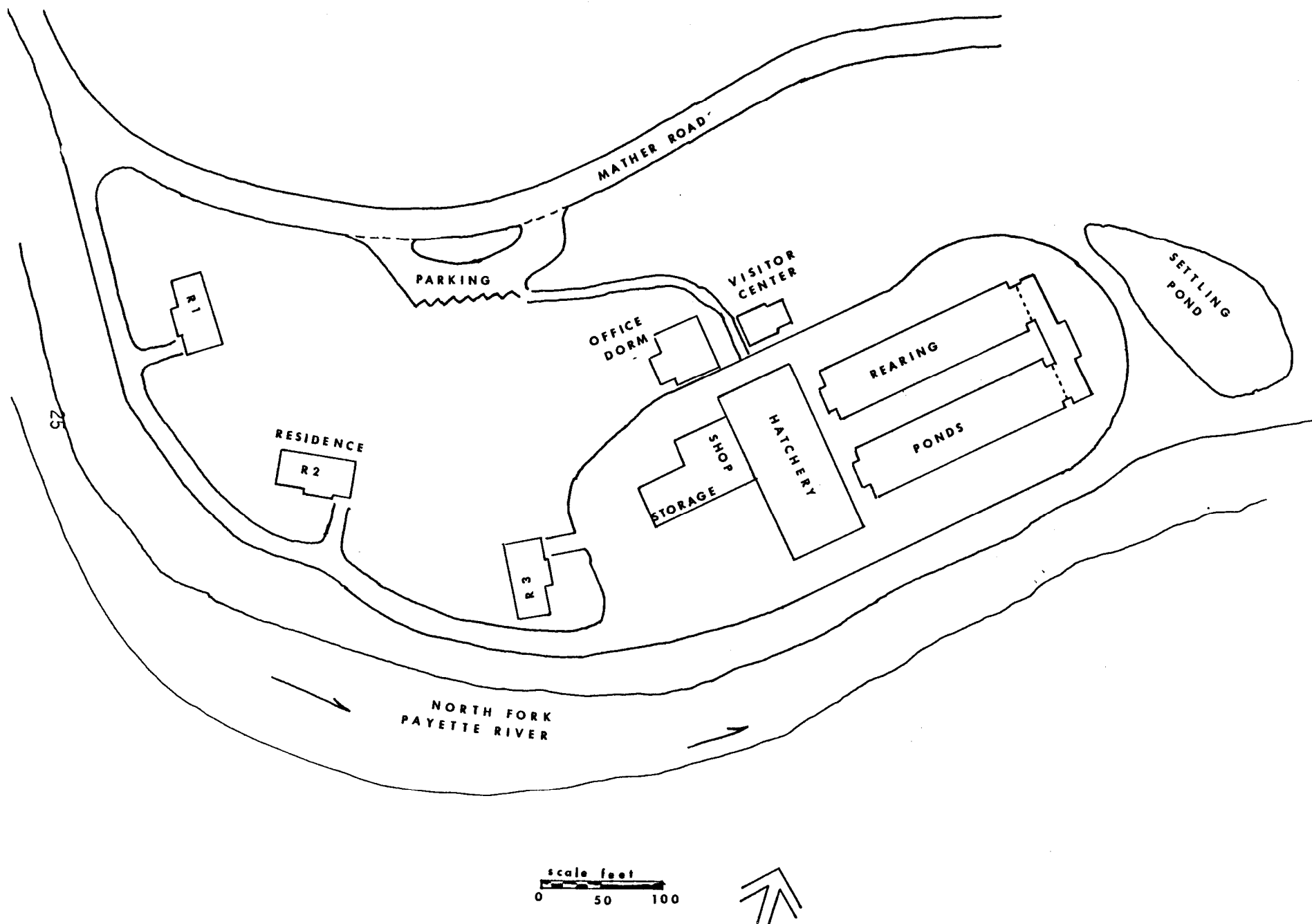
John Hanson, U. S. Fish and Wildlife Service, Boise; Gary Willard, Roger Somerville, Joe Mc Michaels, Pat Streamer, and Jim Douglas, U. S. Army Corps of Engineers, for their help with construction deficiencies.

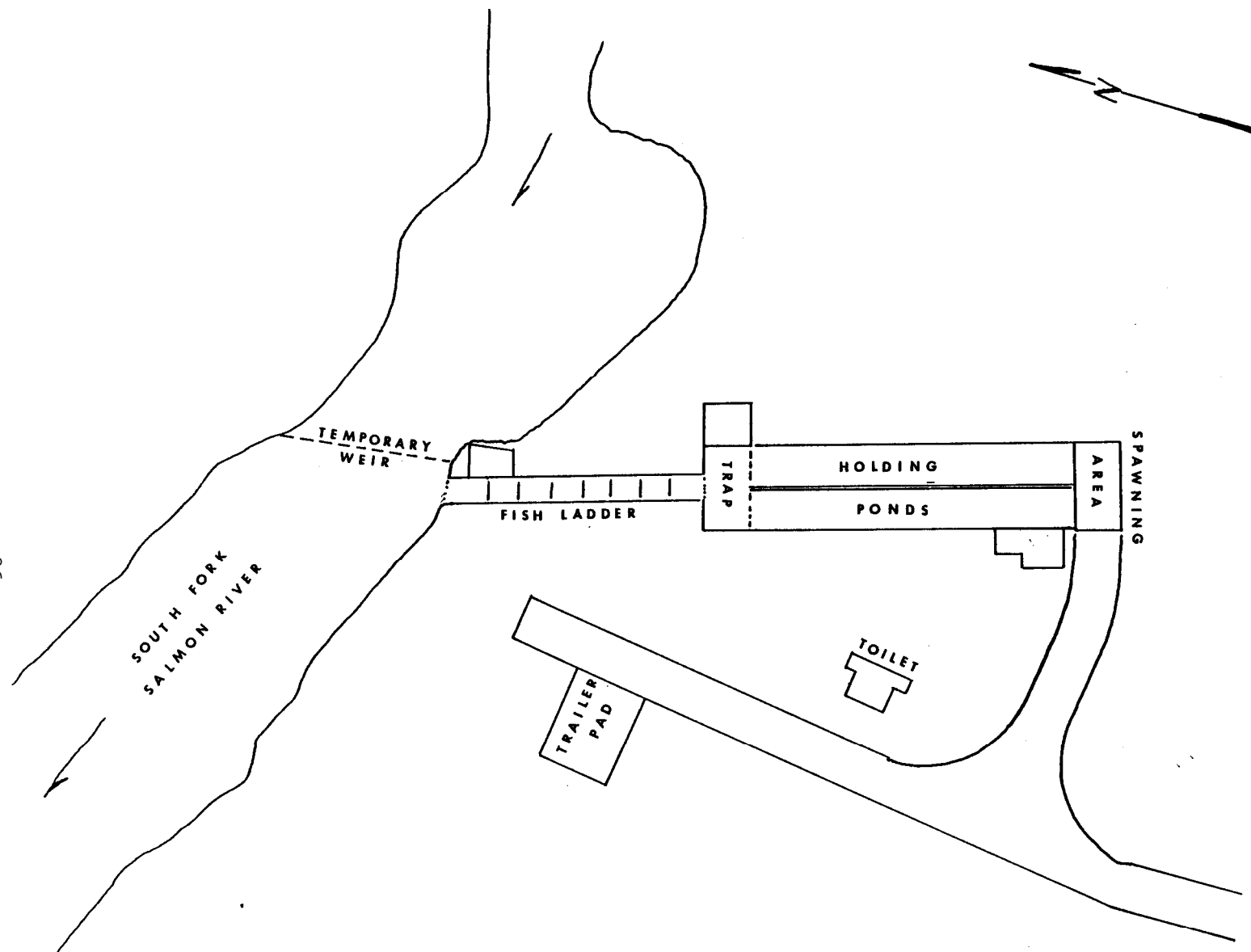
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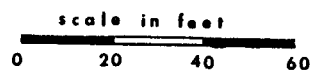
A P P E N D I X

Appendix A. McCall Hatchery site plan.

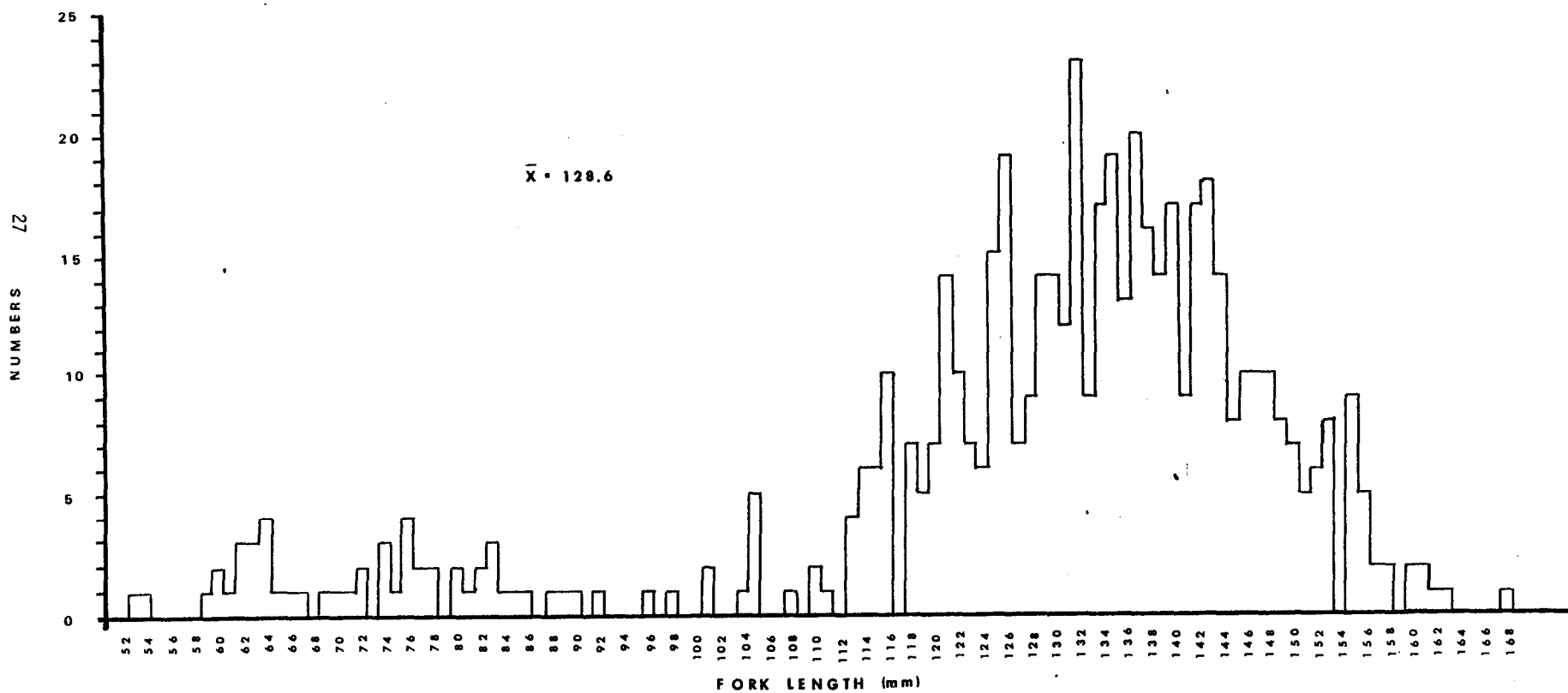




Appendix B. South Fork Salmon River trapping
facility site plan



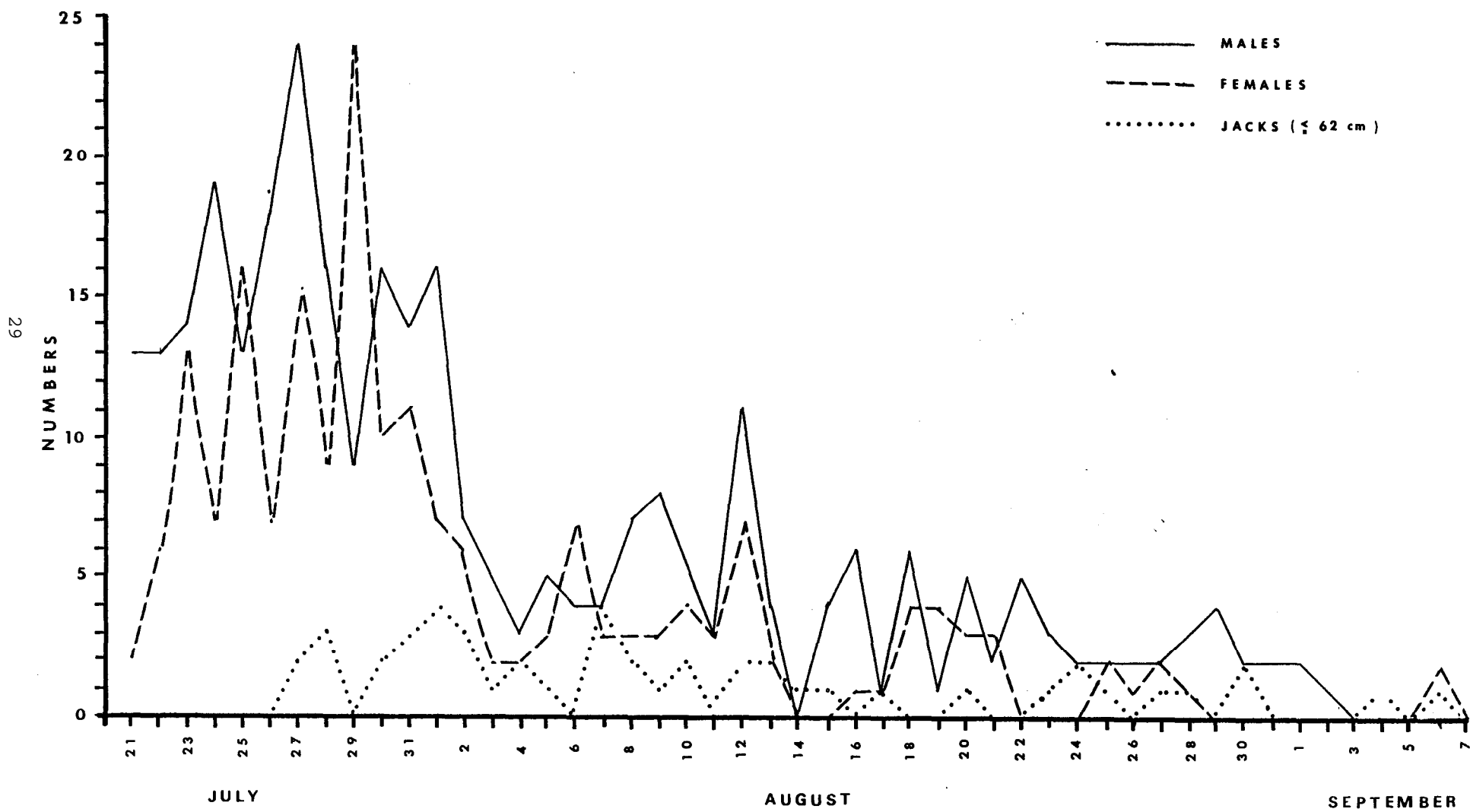
Appendix C. Length frequencies of chinook salmon smolts released in the South Fork Salmon River (1982).



Appendix D. Lengths and numbers of returning adult salmon to the
South Fork Salmon River (1982).

Fork Length (cm)	Males	Females	Fork Length (cm)	Males	Females
46	2	0	76	20	7
47	2	0	77	26	9
48	2	0	78	19	15
49	0	0	79	17	11
50	3	0	80	16	15
51	2	0	81	11	10
52	0	0	82	12	9
53	8	0	83	7	4
54	3	0	84	8	8
55	5	0	85	4	9
56	5	0	86	3	3
57	2	0	87	1	9
58	2	0	88	0	7
59	3	0	89	1	6
60	3	0	90	1	7
61	3	0	91	0	7
62	3	0	92	0	10
63	3	0	93	0	9
64	2	0	94	0	5
65	1	1	95	1	4
66	3	0	96	0	2
67	6	0	97	0	1
68	7	0	98	2	1
69	8	1	99	1	0
70	13	0	100	1	0
71	17	0	101	1	1
72	20	2			
73	24	7			
74	22	7	Totals	354	196
75	28	9			

Appendix E. Timing, by sex, of returning adults to the South Fork trap (1982).



Date _____

Vat/Pond	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	C.B,
Rearing Space (ft ³)																	
Pond Volume (ft ³)																	
Pond Flow (cfs)																	
Turnovers/hr																	
MDI (pond constant)																	
PLI (pond constant)																	
Species																	
#/lb.																	
Pond Weight																	
# Fish																	
Total Length (mm)																	
# Mortality (previous period)																	
%Mortality																	
Density (lb/ft ³)																	
MDI																	
PLI																	
% B.W. Fed																	
Feed Size																	
Feedings/Day																	

Comments: D.O. in_____ D.O. out_____